9. Hart N, Sylvester K, Ward S, Cramer D, Moxham J, Polkey M. Evaluation of an inspiratory muscle trainer in healthy humans. Respir Med 2001;95:526–31.

Reply

Dr. Laoutaris and colleagues believe that high-intensity endurance inspiratory muscle training (IMT) with the TRAINAIR device (Project Electronics Ltd., London, United Kingdom), as used in their nonrandomized studies (1–3), is associated with improvement in peak oxygen consumption (V_{O_2}), while IMT using the threshold device (Threshold Inspiratory Muscle Trainer, Healthscan Products Inc., Cedar Grove, New Jersey) at 30% of maximal inspiratory pressure (PI_{max}), as used in our controlled experiments (4,5), may not increase peak V_{O_2} in patients with chronic heart failure. They failed to note that we also measured PI_{max} during an incremental test and endurance time (4), measurements which they believe to be associated with changes in peak V_{O_2}. In agreement with our findings, other investigators (6) have shown early improvement in PI_{max} and exercise capacity after IMT with the threshold device, and the data of Laoutaris et al. (1) show a 28% increment in PI_{max} after only 4 weeks of IMT (Fig. 3 of Laoutaris et al. [1]). Moreover, in our mechanistic study on patients with heart failure (5), improvement in PI_{max} was correlated with diaphragm hypertrophy, in contrast to their beliefs based on experiments using rat skeletal muscle or inspiratory muscles of normal individuals.

The improvement in ventilatory response to exercise in our study comes as no surprise, since we have recently shown that inspiratory muscle weakness is associated with augmented peripheral chemoreflex response, a major determinant of ventilatory efficiency (7). Therefore, the finding of Laoutaris et al. that ventilatory efficiency did not improve with IMT is probably explained by the inclusion of 79% of patients without inspiratory muscle weakness (3), a bias that may explain the negative results of other trials.

Contrary to the beliefs of Dr. Laoutaris and colleagues., it is the evidence in support of the efficacy of their high intensity endurance IMT in patients with heart failure without inspiratory muscle weakness that is frail. In their efficacy study (1), no correction for multiple comparisons was used, but when the appropriate statistical analysis was applied in their mechanistic studies, no interaction was found for the changes in PI_{max} or in peak V_{O_2} (2,3). Finally, despite the fact that our controlled (4,5) experiments and the data of Laoutaris et al. (1–3) disprove their beliefs, we consider that they have raised interesting hypotheses that must be tested by well-designed research.

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REFERENCES

1. Laoutaris I, Dritsas A, Brown MD, Manguinas A, Alivizatos PA, Cokkinos DV. Inspiratory muscle training using an incremental endurance test alleviates dyspnea and improves functional status in patients with chronic heart failure. Eur J Cardiovasc Prev Rehabil 2004;11:489–96.
2. Laoutaris ID, Dritsas A, Brown MD, et al. Immune response to inspiratory muscle training in patients with chronic heart failure. Eur J Cardiovasc Prev Rehabil 2007;14:679–85.
3. Laoutaris ID, Dritsas A, Brown MD, et al. Effects of inspiratory muscle training on autonomic activity, endothelial vasodilator function, and N-terminal pro-brain natriuretic peptide levels in chronic heart failure. J Cardiopulm Rehabil Prev 2008;28:99–106.
4. Dall'Ago P, Chiappa GR, Guths H, Stein R, Ribeiro JP. Inspiratory muscle training in patients with heart failure and inspiratory muscle weakness: a randomized trial. J Am Coll Cardiol 2006;47:757–63.
5. Chiappa GR, Roseguini BT, Vieira PJC, et al. Inspiratory muscle training improves blood flow to resting and exercising limbs in patients with chronic heart failure. J Am Coll Cardiol 2008;51:1663–71.
6. Martínez A, Lisboa C, Jalil J, et al. Selective training of respiratory muscles in patients with chronic heart failure. Rev Med Chil 2001;129:133–9.
7. Ribeiro JP, Callegaro CC, Schneider FL, et al. Exaggerated peripheral chemoreflex response in heart failure with inspiratory muscle weakness (abstr). J Cardiovasc Prevent Rehabil 2008;15 Suppl 1:S113.